USING COMPOST TO REDUCE SOIL EROSION

H. Clark Gregory, Richard M. Kashmanian, and Steven A. Dressing

AUTHORS: Fulton County Soil and Water Conservation, Room 304, 156 Trinity Ave., SW, Atlanta, GA 30303.
REFERENCE: Proceedings of the 1991 Georgia Water Resources Conference, held March 19 and 20, 1991, at The University of Georgia, Kathryn J. Hatcher, Editor, Institute of Natural Resources, The University of Georgia, Athens, Georgia.

Increasing numbers of communities and businesses are turning to composting to divert materials from landfills, reduce pollution, and lower waste management costs. Composters are converting a wide variety of otherwise wasted materials into safe, valuable, and marketable soil amendment products. Yard trimmings (defined here to include leaves, grass clippings, and brush), food scraps, nonrecyclable paper, food and seafood processing by-products, livestock manures, dead chickens, municipal sewage sludge, and other clean, source separated, decomposable organic materials provide ingredients for the enterprising composter. Researchers are documenting the feasibility of composting an ever increasing array of materials.

It is often reported that composting yard trimmings, food scraps, and nonrecyclable paper can deal with 30 to 60 percent of the municipal solid waste stream. This would represent a tremendous boost to attain municipal solid waste reduction goals. However, there is a growing concern about markets as the supply of compost mounts. Where will all the compost go? Who are the avid users who will eagerly seek more?

A dramatic example of the rise in composting is evident from the results of *BioCycle's* survey of the states. Between December 31st of 1988 and 1989, the number of facilities composting yard trimmings rose from 651 to 986, a jump of over 50 percent. Between September 1990 and January 1, 1993, at least nine more states (Connecticut, Florida, Iowa, Massachusetts, Minnesota, Missouri, North Carolina, Ohio, Pennsylvania, and Wisconsin) will join Illinois and New Jersey in officially banning some or all types of their yard trimmings from landfill disposal.

The astute compost producer will produce compost to meet the needs and specifications of customers and any applicable government regulations. It is also important to note that compost marketing is not only affected by various compost process and product considerations, but also by the image projected. For example, if composting is referred to as a "disposal" practice or as a means of "getting rid of yard wastes," finding ready and willing customers to "get rid of" the compost may be difficult. Instead, compost needs to be considered and marketed as a resource from which definite benefits can be derived. Words are important. The terms used to describe the composting process or product, and its role in waste management, are important to greater acceptance of compost into the marketplace. Composting should be presented as a production process, not waste disposal.

ENVIRONMENTAL BENEFITS

Waste stream managers view composting primarily as a means to divert materials from disposal facilities. The environmental benefits, however, only begin here. Others are derived from use of the product. These benefits have been widely reported in the literature--increased aeration, improved moisture and nutrient retention, decreased soil erosion, reduced soil surface crusting, plant disease suppression, improved tilth, etc. Indeed, the ability to compost to reduce pollutant carrying runoff and leachate (primarily due to its organic matter content) can provide surface and ground water quality benefits (e.g., Maynard, 1989; and Brinton, 1985).. The single, most important measure of a soil's fertility is its organic content. Compost applied to disturbed or damaged lands can help restore both organic content and soil.

To realize the full potential of composting, the wide range of multiple environmental benefits needs to be recognized. This paper focuses primarily on taking advantage of the soil and water quality benefits that can be obtained through widespread and appropriate use of compost.

NONPOINT SOURCE POLLUTION

Research has shown that composted animal manure can help reduce erosion, as well as runoff and leaching of nitrates, as compared to fertilizer and uncomposted animal manure. Use of composted animal manure has also produced generally higher yields than use of fertilizer (Maynard, 1989), though this may be more likely during a drought. Other research indicates that under certain conditions, compost can suppress plant diseases and reduce the need for pesticides/fungicides. These types of research results have led to increased recognition that proper compost use can reduce nonpoint source water pollution problems.

Nonpoint source pollution is generally considered to consist of the pollutant discharges typically carried by runoff or leachate to surface or ground waters. The pollutants include sediment, nutrients, pesticides, metals, and pathogens. The U.S. Environmental Protection Agency has estimated that nonpoint source pollution contributes 45 percent, 76 percent, and 65 percent of the pollutants to impaired estuaries, lakes, and rivers, respectively.

Agricultural runoff sources are the most pervasive cause of nonpoint source-related water quality problems, estimated to be responsible for about 57 and 64 percent of the nonpoint source impacts to lakes and rivers, respectively. These sources include cropland, pasture land, rangeland, and livestock operations.

Construction activities account for up to five percent of the nonpoint source impacts to the nation's surface waters (EPA, 1989). Land development accounts for more than half of the reported construction impacts to rivers and lakes.

The nonpoint source impacts of agricultural and construction related activities could be substantially mitigated by increasing the use of compost by these sectors. This paper describes mechanisms for stimulating these two potentially major users of compost--farmers and land developers.

AGRICULTURAL USE

As discussed above, the contribution of pollutants from the agriculture sector is substantial. Encouraging farmers to use compost made on, or off, the farm can reduce erosion and improve water quality. Institutional mechanisms for encouraging farmer use of compost include: 1) Its explicit recognition as a nonpoint source control practice (also referred to by U.S. Department of Agriculture [USDA] as a conservation practice); 2) Its incorporation into state nonpoint source management programs; 3) Its inclusion into federal (EPA and USDA) and state and local cost-share programs; 4) Allocation of monies from state and local grants, disposal surcharge fees, and other funding sources to subsidize farmers and encourage this type of recycling market development activity; and 5) Payments to farmers as private composters which could indirectly provide incentives for them to use their compost products.

Farm policy calling for sharing farmers' costs may be needed to help purchase specialized compost (production and) application equipment. In addition, since greater volumes of compost would be needed to supply the same nutrient level of fertilizer, cost- sharing may be needed to help defray the cost of purchasing or transporting the compost. (Note: Encouragement of on farm composting paves the way to also encourage on farm composting of yard trimmings, nonrecycled paper, and other source separated and uncontaminated organic materials, and the application of compost.)

Several examples already exist where various states and other jurisdictions have provided for the above. These include:

- The USDA/Agricultural Stabilization and Conservation Service (ASCS) in Georgia cost-shares the purchase of poultry litter (i.e., chicken manure and bedding) when substituted for fertilizer.
- Under certain conditions, USDA/ASCS allows its county offices in Tennessee to cost-share the use of sewage sludge compost based on the nutrient content.
- ASCS allows at least one county in Minnesota to cost-share the use of compost to supply nutrients in seeding.
- Nebraska is considering a program to expand compost markets through its Natural Resources Districts. If implemented, this program would allow a farmer to receive a higher cost-share if compost were applied in addition to using a more traditional conservation practice.
- Delaware, assisted by EPA nonpoint source control funds (discussed below), is cost-sharing at 90 percent the composting of dead chickens, with chicken manure and straw. The State of Alabama also cost-shares the composting of dead poultry (with chicken manure and straw, or other carbon material source) to mitigate disposal and surface and ground water quality problems.
- New Jersey approved a permit for a farmer to compost horse manure from his and neighboring horse farms to address a serious nonpoint source pollution problem. USDA/Soil Conservation Service (SCS) agreed to cost-share over 40 percent of the project. though the latter two examples do not explicitly include the use of compost, they do demonstrate the connection between composting and water quality protection.

In its latest versions of the 1990 Farm Bill, the U.S. Congress sees a greater role for USDA in composting. USDA/SCS is currently developing a technical guide for on farm composting. USDA/ASCS has developed specifications for cost-sharing the composting of dead poultry. In addition, EPA has included in its draft 1990 Report to Congress on nonpoint source pollution control activities a section on the merits of composting and the use of compost. This can help to forge composting's beneficial role in the water quality policy arena.

LAND DEVELOPMENT APPLICATIONS

There are presently 25 states with erosion and sediment control legislation. These laws contain provisions to approve erosion and sediment control plans and issue permits for land disturbance activities. In the state sediment and erosion control regulations and guidelines, soil testing is recommended to determine planting needs. In lieu of a soil test, recommended application levels of grass seed, fertilizer, topsoil, mulch, and lime are suggested as at least a guide.

In preparation for writing this paper, the authors contacted environmental/natural resource and soil and water conservation districts in several states (Illinois, Maryland, North Carolina, Pennsylvania, Virginia, and Wisconsin) and counties (Montgomery and Prince George's Counties in Maryland) for information on their erosion and sediment and control programs. (In addition, their erosion and sediment control manuals were reviewed.) Each of the contacted representatives was familiar with the merits of using compost.

This suggests that many people in the environmental protection field are aware of the nation's solid waste disposal problems and the increased interest in composting. They may even be considered an interested audience. Those interviewed stated that they would not be averse to approving the use of compost, as long as the soil is stabilized after development occurs--i.e., as long as permanent ground cover vegetation is established. They expressed a concern about the cost and availability of the compost. If these concerns can be adequately addressed along with achieving the desired product quality, compost could be used during soil stabilization to provide organic matter and perhaps to reduce the amount of topsoil and fertilizer.

To give an example of the amount of compost that could be used, one inch of compost spread over an acre represents approximately 65 tons at a 40 percent moisture content. (Compost typically contains 40 to 60 percent moisture level.) For a five acre landscaping project, that would represent 325 tons of compost. This may represent more compost than what is produced by a community. With such an attractive market potential, composting activity could be expanded to include inputs from more households and additional organic materials.

It is also important to consider converting organic materials into mulch, to provide benefits such as reducing raindrop impact and erosion, retaining moisture, fostering plant growth, suppressing weeds, etc. Wood chips, bark, and straw are among the mulch materials listed in state and county manuals. Chipped brush and other woody materials could possibly be used as mulch.

There are different institutional mechanisms to encourage land developers to use compost. The first option could be voluntary, by allowing the use of compost as part of a soil stabilization plan to prevent erosion. A second option could be more forceful, whereby the developer essentially becomes a procurement agency, e.g., if the compost is available at the "right" price and "right" quality, then it "should" or "must" be used. Ideally, under both of these options, compost producers and suppliers could contact land developers and provide details of their available compost so that land developers could plan to use it. If needed, post-processing steps could be followed. Public officials could serve as intermediaries by announcing the schedule of development projects and availability of compost.

A third mechanism could be more indirect. Grass sod can be used to stabilize areas immediately rather than planting grass seed. Use of compost to grow sod could be encouraged through appropriate incentives.

Listed below are examples of how several states and other jurisdictions handle land development activities:

- Maryland allows the use of composted sewage sludge (with specified nutrient content and pH levels and produced at a state permitted facility) as a soil amendment or conditioner to reduce applications of commercial fertilizer and lime needed for permanent seeding.
- Pennsylvania allows the use of composted sewage sludge and wood chips from an approved facility (with specifications for organic matter, ash content, water holding capacity, particle size, pH, heavy metals, and PCBs) to be used as a mulch to help establish seeded areas.
- North Carolina and Virginia allow the use of sludge and "rotted manure" as soil conditioners during permanent seeding. One of Virginia's handbooks recognized the importance of creating compost markets, as well as the need for safe levels of heavy metals in solid waste and sludge compost.
- All state agencies in California must give preference to purchasing compost if it can be substituted for, and is competitive with, fertilizer and/or soil amendment products. The types of land applications include recultivation and erosion control, and must satisfy state standards and regulations.
- The Department of Public Works in Suffolk County, New York requires a minimum of six percent organic matter in topsoil in their landscaping specifications. These specifications are based on those used by the state's Department of Transportation.
- In Summit County, Colorado, land developers must employ nonpoint source control practices during new development to reduce phosphorus runoff to a local reservoir. Otherwise, they will not be granted permission to develop.

An appealing feature of this approach for encouraging land developers to use compost is that it would operate within an existing infrastructure. Furthermore, the second option of going beyond a voluntary program is a cross compliance technique, i.e., to receive permission to develop on land, compost use must be considered during the stabilization phase. This approach is similar to the State of New Jersey's recommendation that a residential source separation clause be

included in new lease and sales agreements for multi-family buildings. Just as we pay our mortgage or rent now for next month, using compost in the development of a new area is a "payment" prior to the yard trimmings from the new development being discarded and adding to the local solid waste stream.

Even though use of compost is allowed (and organic matter is encouraged) in the sediment and erosion control provisions for Maryland, North Carolina, Pennsylvania, and Virginia, it is not often used to grow permanent vegetation. The reasons given were: 1) Landscape contractors are not accustomed to using compost; 2) Land developers may view compost use as an unnecessary expense; 3) the price of compost versus other soil amendments; 4) The lack of information on compost quality, availability, and suppliers; and 5) Compost was more often used in small projects.

The authors suggest the following to overcome these barriers: 1) Demonstrate to these groups the benefits of using compost to attain permanent vegetation; 2) Estimate the "life-cycle costs" to achieve permanent vegetation with and without using compost, and determine the need for financial incentives to encourage compost use; and 3) Provide detailed information on compost (and mulch), including suppliers and availability to land developers and landscape contractors.

FUNDING SOURCES

In 1990, EPA provided $36.9 million in grants to all states with approved nonpoint source management programs under section 319 of the Clean Water Act, as amended in 1987. Grants were made to all states with approved nonpoint source management programs. These programs address those nonpoint source problems identified by the states in their section 319 nonpoint source assessment plans. Programs include the following: Identification of nonpoint source pollution control measures to be used by the state; methods for achieving implementation of these measures; a schedule for implementation; and sources of funding. Note that this discussion refers only to funding sources for controlling nonpoint source pollution.

USDA made approximately $180 million available for sharing the cost of soil conservation and environmental protection practices with farmers and ranchers in fiscal year 1989 under its Agricultural Conservation Program. Several states also have cost-sharing programs to help landowners implement nonpoint source control measures.

CONCLUSIONS

Composting provides a way in which solid waste and water quality concerns can be joined together to form a viable environmental and economic solution. Composting can also combine human and financial resources from solid waste, soil, water quality, and other environmental protection fields. Several steps have been identified which can help promote the use of compost and its water quality benefits: 1) Determine the institutional mechanisms, barriers, and financial resources available, obstructing, or needed to encourage compost use; 2) Involve the appropriate public and private agencies, industries, and other groups; 3) Identify the targeted potential user groups and users, and their soil amendment needs (including compost quality and availability); and 4) Determine the need for incentives and design them according to each user group. This will enhance opportunities for greater use of compost. Ultimately, the value of compost should increase.

REFERENCES

Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), "America's Clean Water--The States' Nonpoint Source Assessment 1985," January 1986.

BioCycle, "Boston, Massachusetts: Leaf Composting Workshops," Vol. 31, No. 8, August 1990, p. 21.

Brinton, W., Jr., "Nitrogen Response of Maize to Fresh and Composted Manure," *Biological Agriculture and Horticulture*, Vol. 3, 1985, pp. 55-64.

Brinton, W.F. and M.D. Seekins, *Composting Fish By-Products: A Feasibility Study*, Time & Tide Resource Conservation and Development (RC&D) Council, Waldoboro, Maine, 1988.

Garner, M., "Summary of Principal Provisions of State Laws Providing for Erosion and Sediment Control as of July 1, 1985," National Association of Conservation Districts, 1985.

Glenn, J., "Regulating Yard Waste Composting," *BioCycle*, Vol. 30, No. 12, December 1989, pp. 38-41.

Glenn, J., "The State of Garbage in America," *BioCycle*, Vol. 31, No. 3, March 1990, pp. 48-53.

Glenn, J. and D. Riggle, "Where Does the Waste Go?," *BioCycle*, Vol. 30, No. 4, April 1989, pp. 34-39.

Gregory, C., "Compost May Be the Most Misunderstood Product in America," *Compost Science*, Vol. 14, No. 6, November/December 1973, pp. 26-27.

Hoitink, H.A.J. and G.A. Kuter, "Role of Composts in Suppression of Soilborne Plant Pathogens of Ornamental Plants," *BioCycle*, Vol. 25, No. 4, May/June 1984, pp. 40-42.

Hornick, S.B., "Organic Wastes for Revegetating Marginal Lands," *BioCycle*, Vol. 23, No. 4, July/August 1982, pp. 42-43.

Hornick, S.B. and J.F. Parr, "Restoring the productivity of marginal soils with organic amendments," *American Journal of Alternative Agriculture*, Vol. 2, No. 2, Spring 1987, pp. 64-68.

Lamb, E., National Association of Conservation Districts, personal communication, June 1990.

Logsdon, G., "New Sense of Quality Comes to Compost," *BioCycle*, Vol. 30, No. 12, December 1989, pp. 48-51.

Logsdon, G., "Plant Protection Through Compost," *BioCycle*, Vol. 31, No. 1, January 1990, pp. 52-54.

Maynard, A.A., "Agricultural composts as amendments reduce nitrate leaching from soil," *Frontiers of Plant Science*, Vol. 42, No. 1, Fall 1989, pp. 2-4.

New Jersey Department of Environmental Protection (NJDEP), "Recycle! A Recycling Guide for Landlords and Managers of Multi- Family Buildings," Division of Solid Waste Management, Office of Recycling, undated.

Sampson, R.N., *Farmland or Wasteland: A Time to Choose*, Rodale Press, Emmaus, Pennsylvania, 1981.

Seekins, B., *Usable Waste Products for the Farm: An Inventory for Maine*, Maine Department of Agriculture, Food and Rural Resources, Augusta, Maine, 1986.

U.S. Department of Agriculture (USDA), *Teaching Soil and Water Conservation: A Classroom and Field Guide*, Soil Conservation Service, Program Aid Number 341, 1988.

U.S. Environmental Protection Agency (EPA), *A Report to the Congress: Activities and Programs Implemented Under Section 319 of the Clean Water Act--Fiscal Year 1988*, Office of Water, August 1989.

_____. *Draft Fiscal Year 1989 Nonpoint Source Report to Congress, Office of Water*, June 1990.

_____. *National Water Quality Inventory, 1986 Report to Congress*, Office of Water, November 1987.

WasteTech News, "State Briefs: Missouri," Vol. 2, No. 24, August 3, 1990, p. 4.